TI:

Configurations Part I

Unclassified

Safety & Environmental Impact is “LOW”

TI: Transistor Configurations Part I

Terminal Learning Objective

ACTION:

Given a schematic diagram identify the 3 configurations, 4 Classes of amplifiers, Static & Dynamic operation, characteristics of the Common Emitter Amplifier & troubleshooting procedure to lead in a diagnose of malfunctions based on symptoms given.

CONDITIONS:

With Out references.

STANDARD:

Of 10 questions correctly answer 7.

TI: Transistor Configurations Part I

Introduction

This lesson is comprehensive in its presentation. The principles of operation & troubleshooting will be very similar if not the same for any amplifier or transistorized Ckt covered in future lessons.

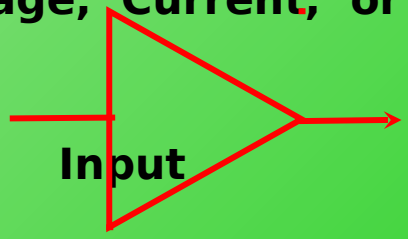
TI: Transistor Configurations Part I

AMPLIFICATION;

The process of increasing the magnitude of a signal operating parameter without changing the Frequency.

The increase can be Voltage, Current, or Power.

Amplifier Symbol:



Equilateral Triangle. Input
Output

GAIN;

Is the increment of measure that describes the increased magnitude of the output signal compared to the input signal. Symbol is G.

Formula; Gain = V pp Output, over V pp input

$$G = \frac{\text{Output}}{\text{Input}}$$

Output = 10 V pp

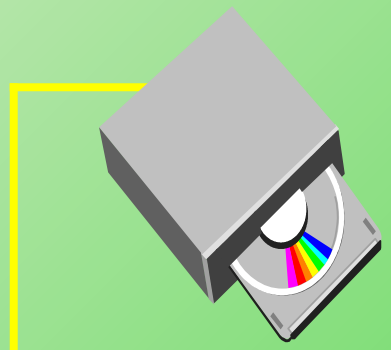
Input = 2 V pp

G = 5

Gain Cont.

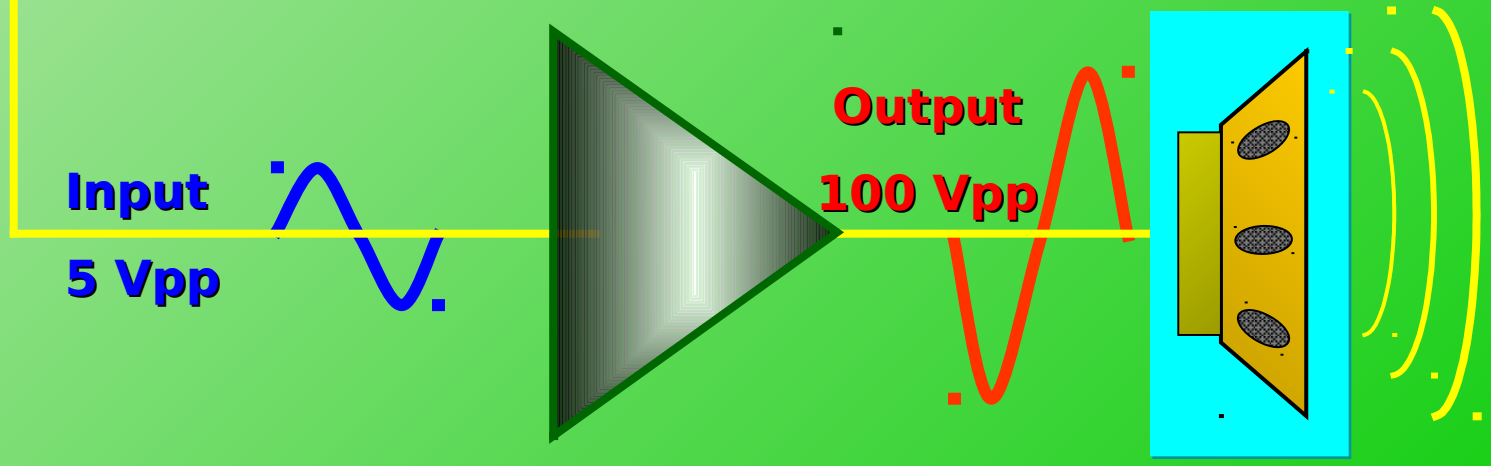
TI: Transistor Configurations Part I

GAIN; A comparison of the Output over the Input.



$$\frac{\text{Output}}{\text{Input}} = G \qquad \frac{100\ \text{Vpp}}{5\ \text{Vpp}} = 20$$

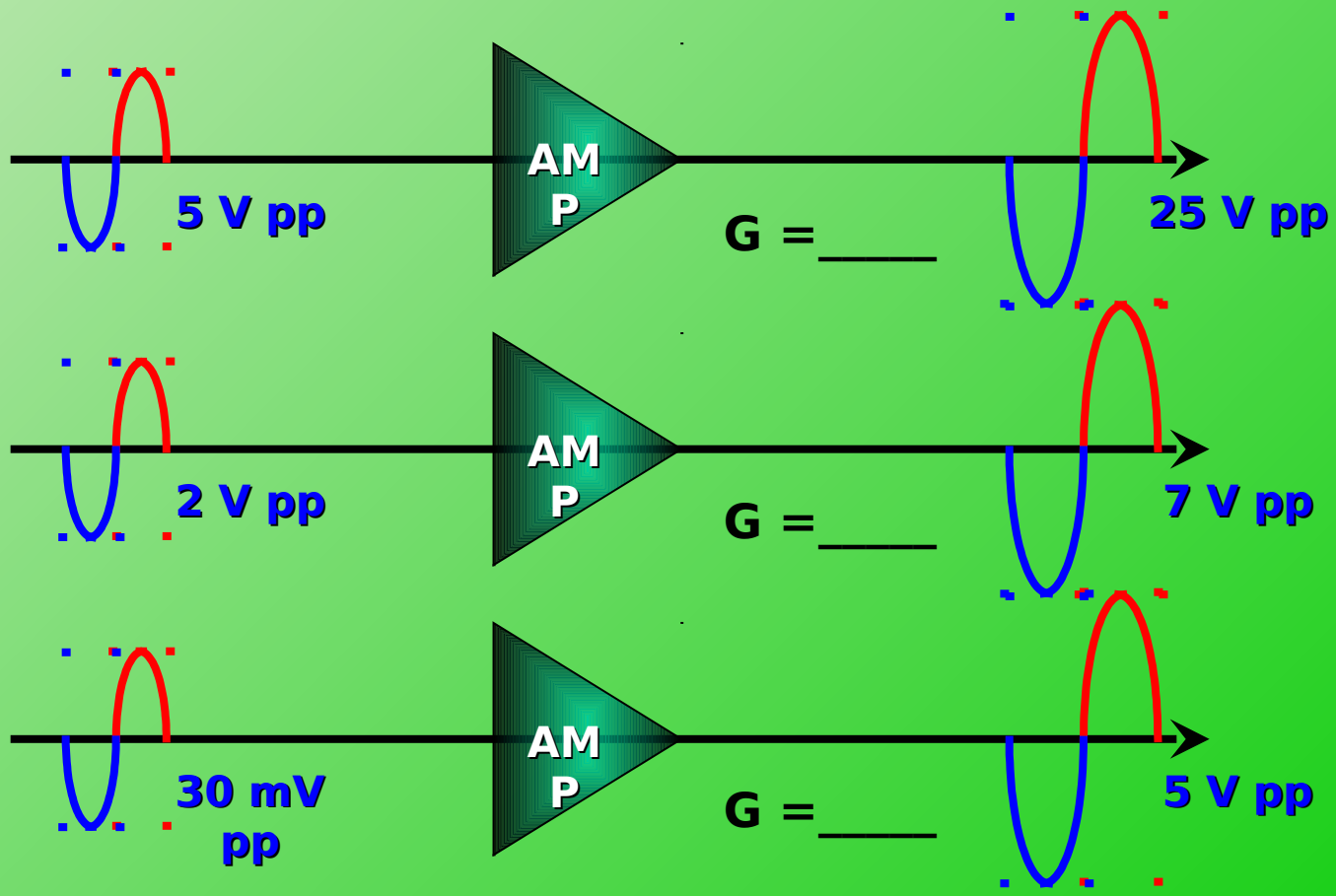
$$G = 20$$



Challenge

TI: Transistor Configurations Part I

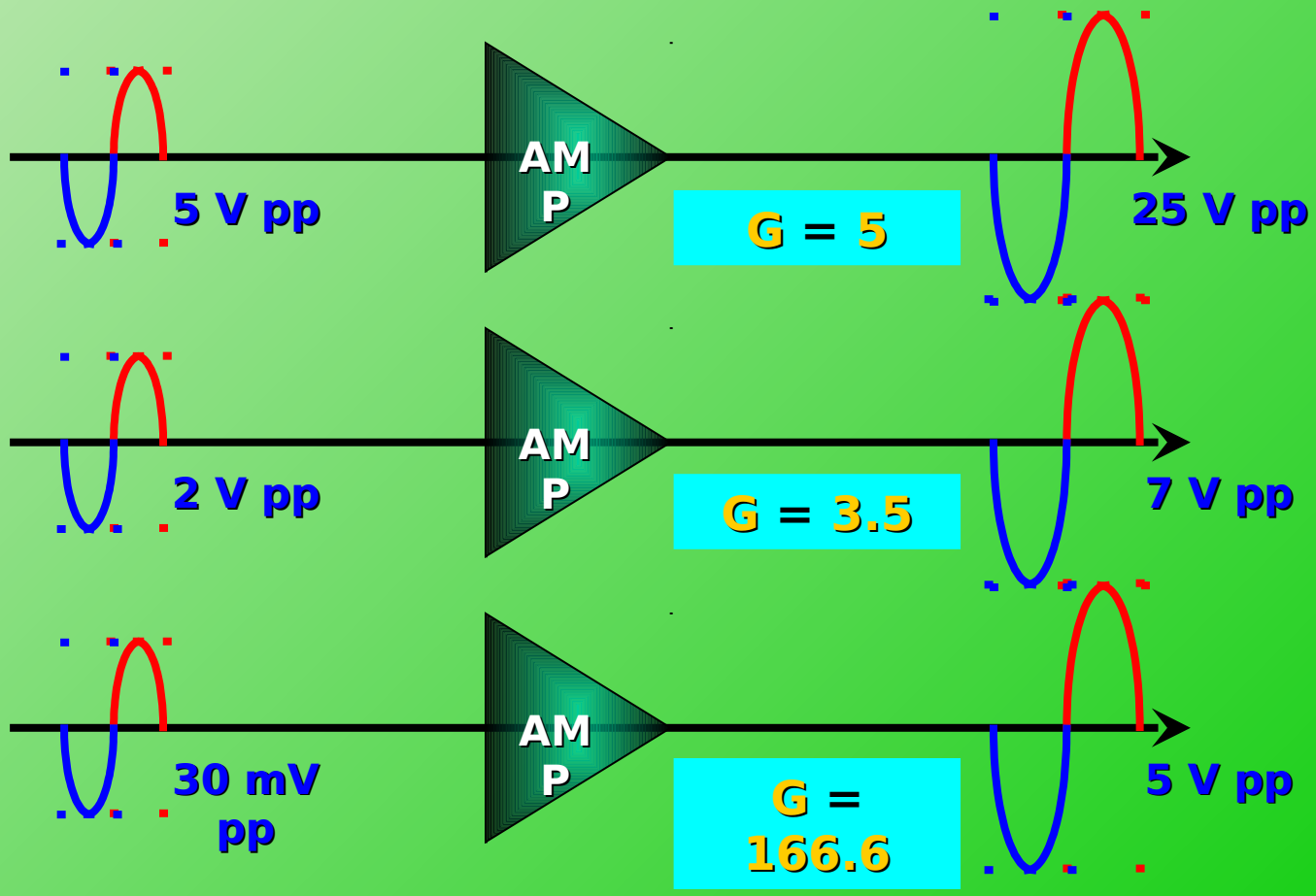
CALCULATE GAIN: Gain = Output / Input



Answers

TI: Transistor Configurations Part I

CALCULATED GAIN: Gain = Output / Input

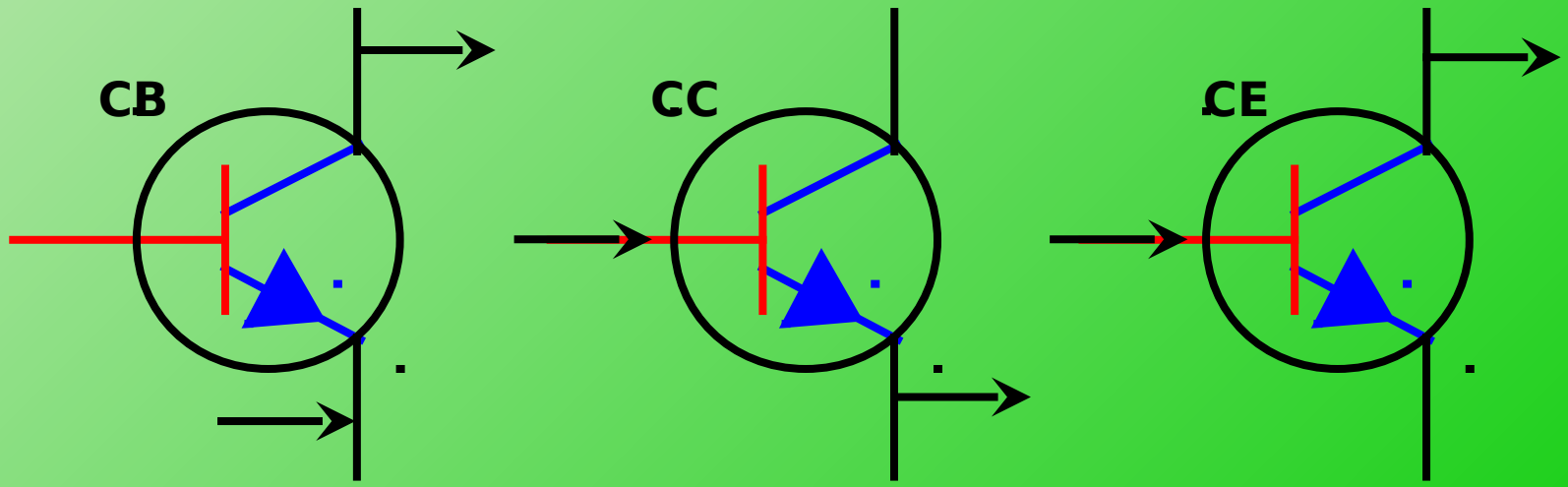


Amp Types

TI: Transistor Configurations Part I

AMPLIFIER TYPES:

Since 1 Amplifier cannot amplify all entities of Voltage, Current & Power, 3 different configurations of amplifiers are required. They are described by the common element or the element that is not being used by either the Output or Input.



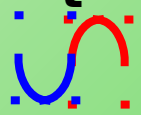
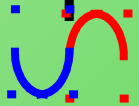
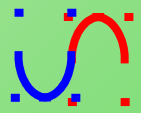
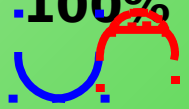
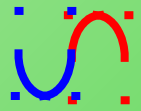
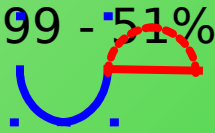
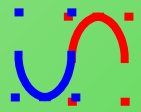
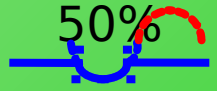
COMMON BASE **COMMON COLLECTOR** **COMMON EMITTER**

Voltage Amp **Current Amp** **Power Amp**

V **I** **P**

Amp Class Chart

TI: Transistor Configurations Part I

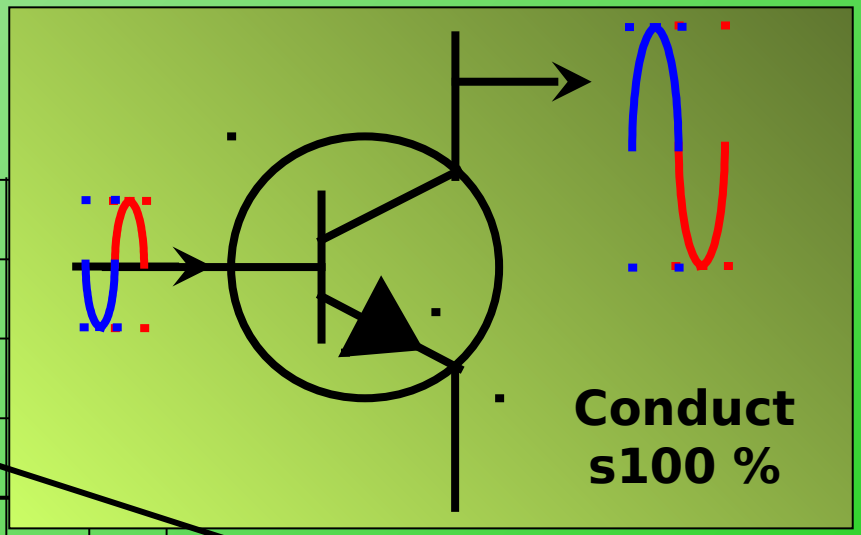
Class	Input	Output, % of I	Fidelity	Efficiency
A			****	*
AB		100% 	***	**
B		99 - 51% 	**	***
C		50% 	*	****

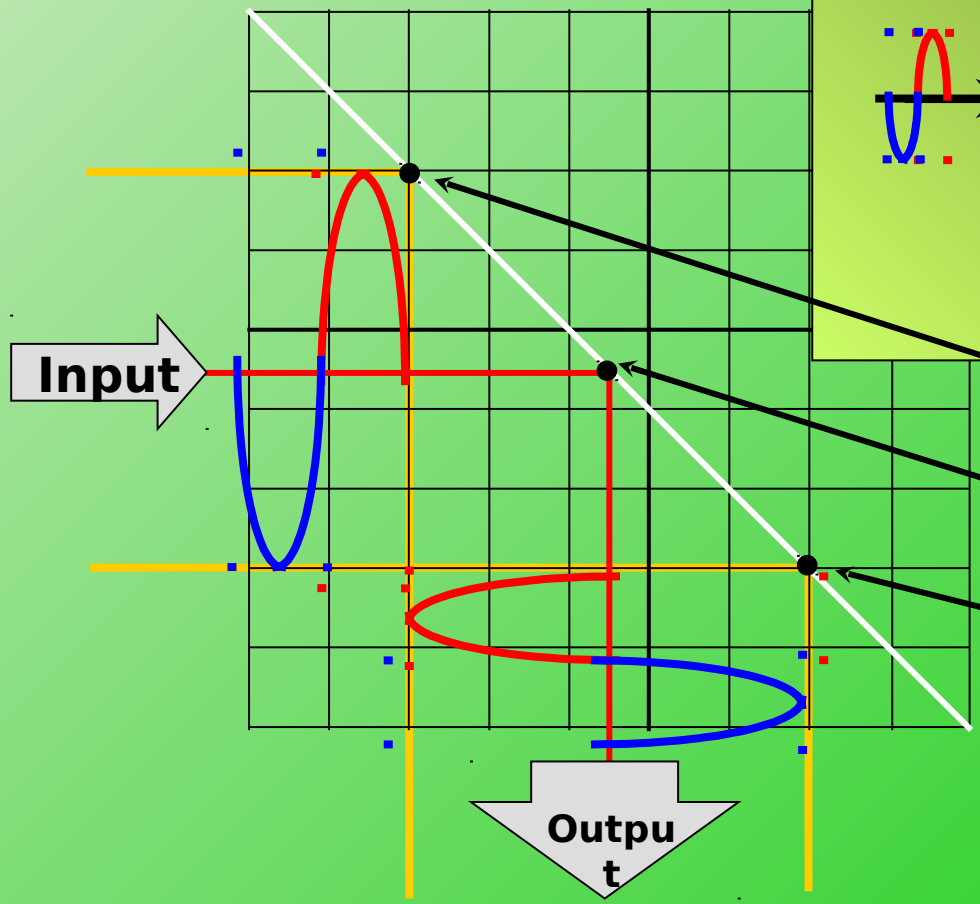
< 50%

Class **A** Detail

TI: Transistor Configurations Part I

CLASS A AMPLIFIER





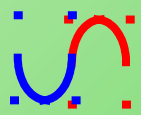
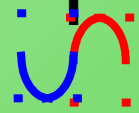
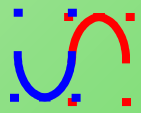
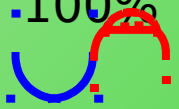
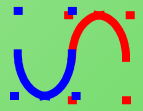
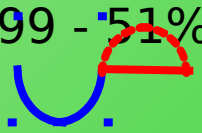
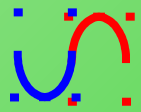
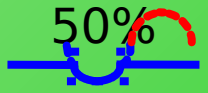
Upper Limit.

DC Bias set @ Optimum.

Lower Limit.

Class C

TI: Transistor Configurations Part I

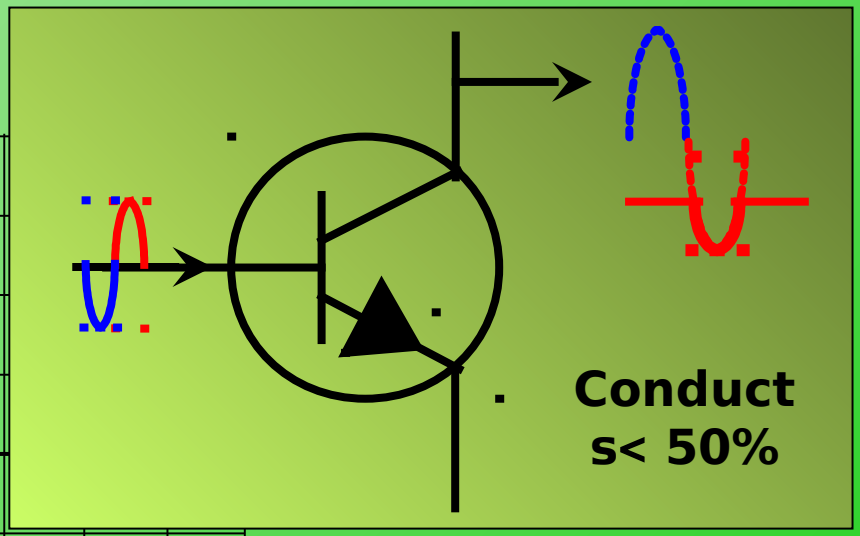
Class	Input	Output, % of I	Fidelity	Efficiency
A			****	*
AB		100% 	***	**
B		99 - 51% 	**	***
C		50% 	*	****

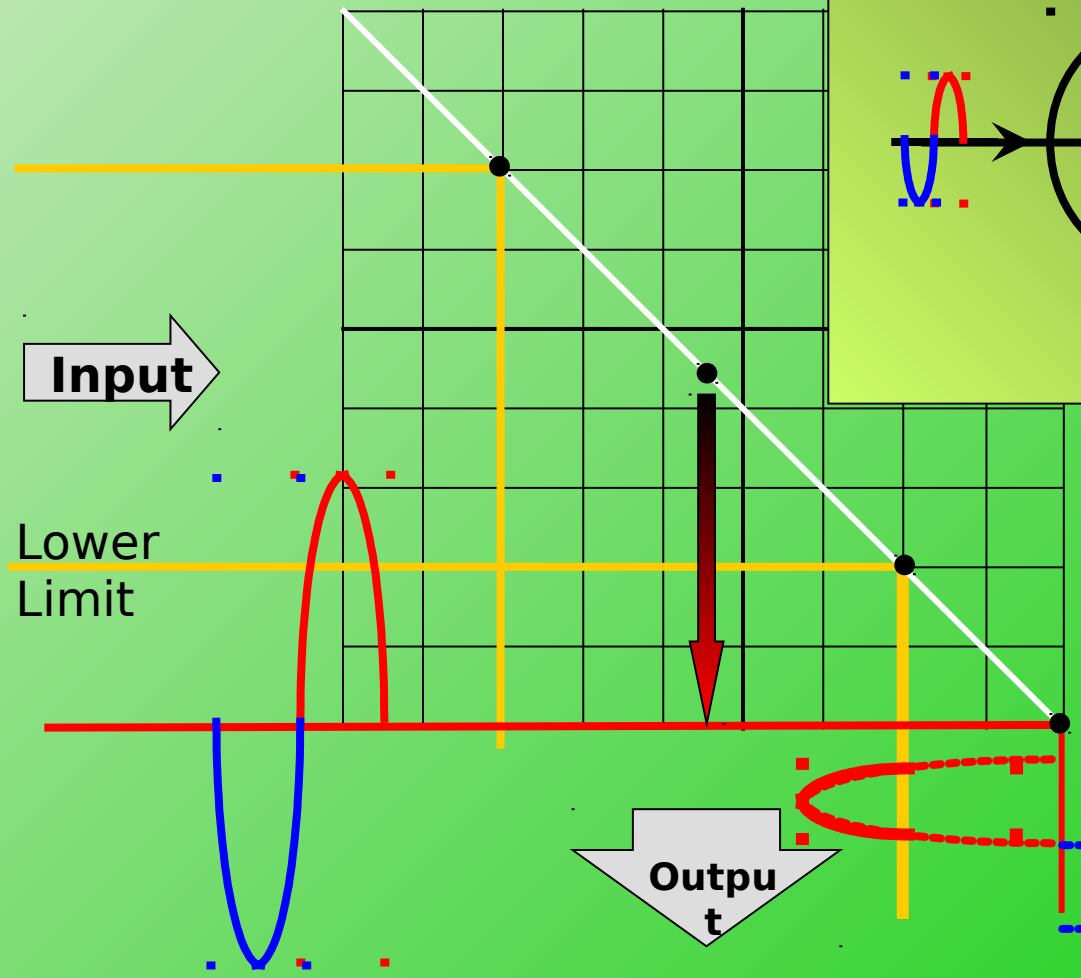
< 50%

Class **C** Detail

TI: Transistor Configurations Part I

CLASS C AMPLIFIER

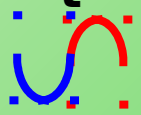
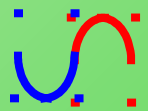
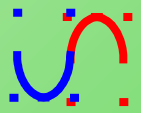
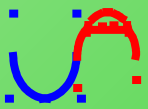
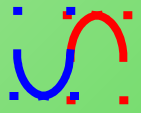
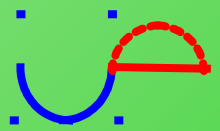
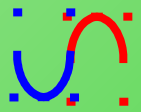
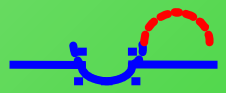




Note: The DC Bias has been reduced below the lower operating limit. The transistor is only conducting during that portion of time above the lower limit.

Class AB

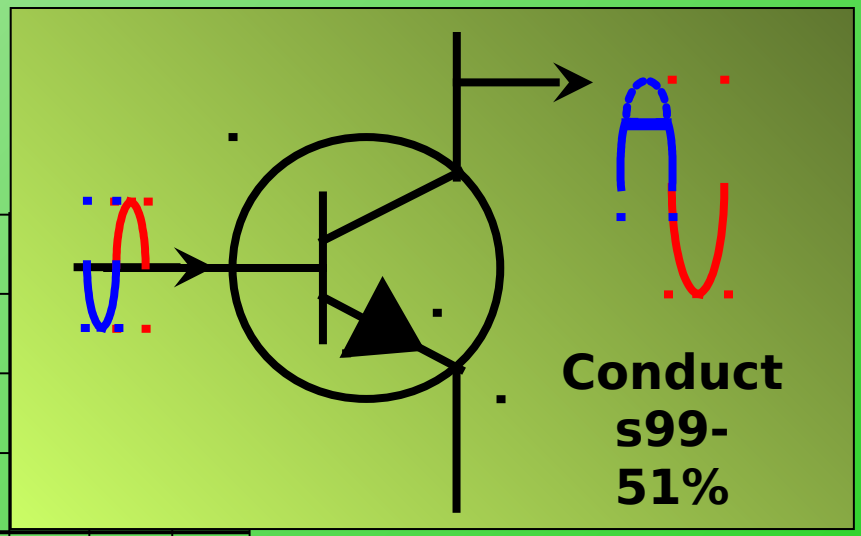
TI: Transistor Configurations Part I

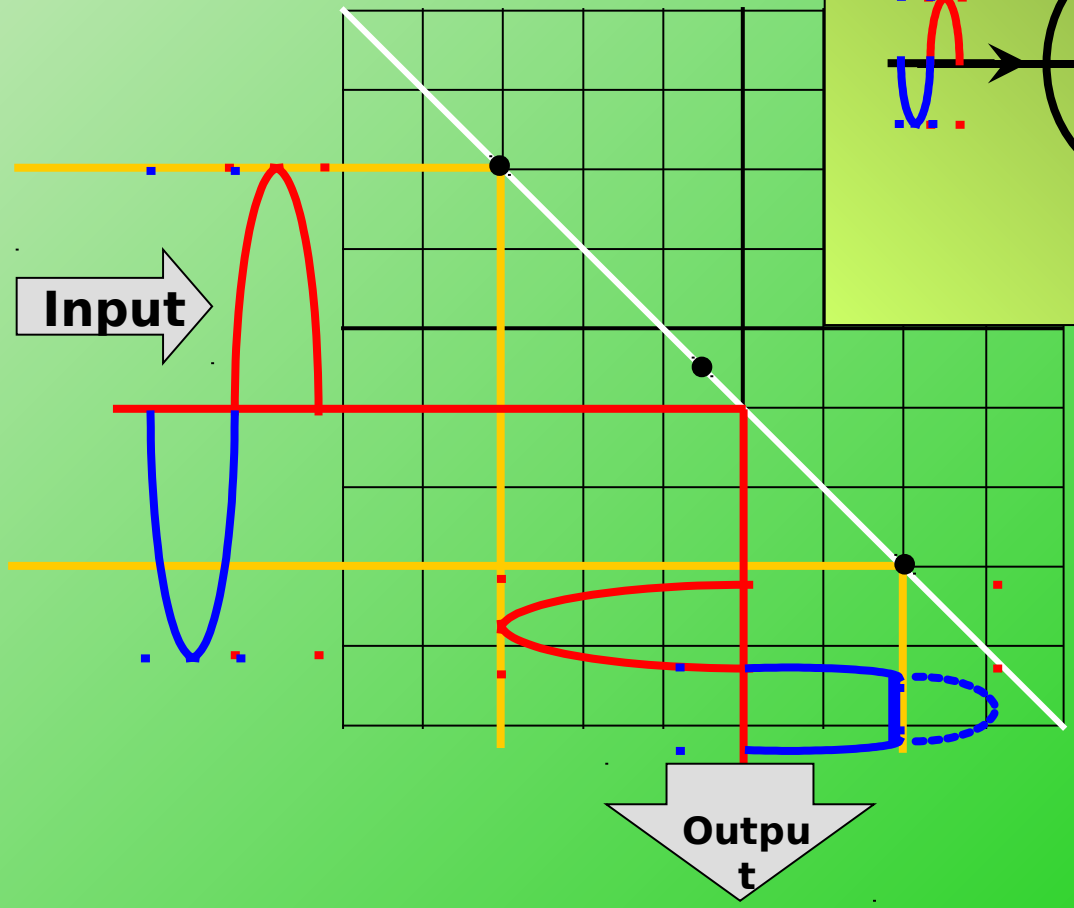
Class	Input	Output, % of I	Fidelity	Efficiency
A		 100%	****	*
AB		 99 - 51%	***	**
B		 50%	**	***
C		 < 50%	*	****

Class **AB** Detail

TI: Transistor Configurations Part I

CLASS AB AMPLIFIER

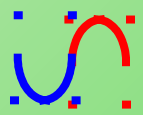
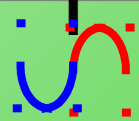
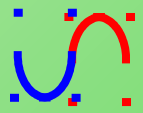
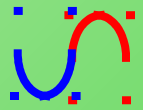
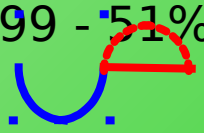
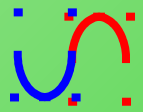
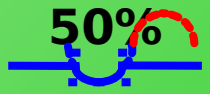




The DC Bias has been reduced from the optimum. A portion of the input falls below the lower limit, no conduction occurs during that time.

Class B

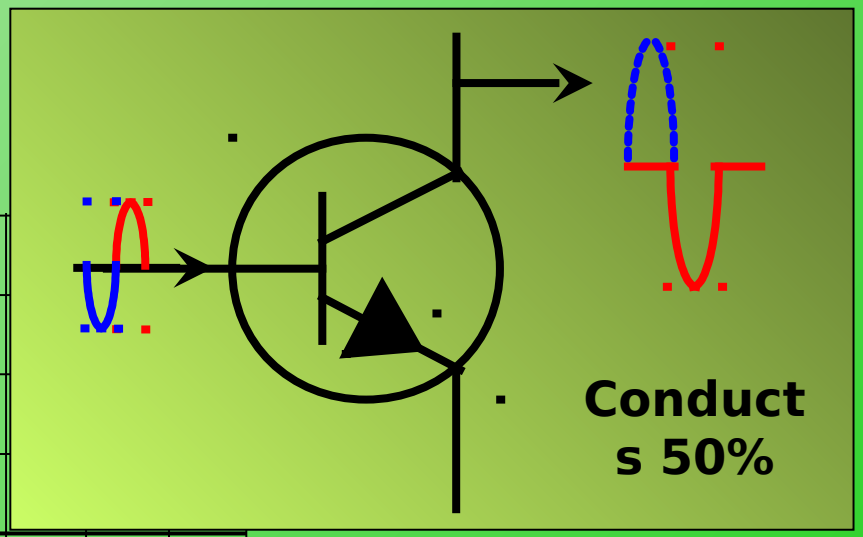
TI: Transistor Configurations Part I

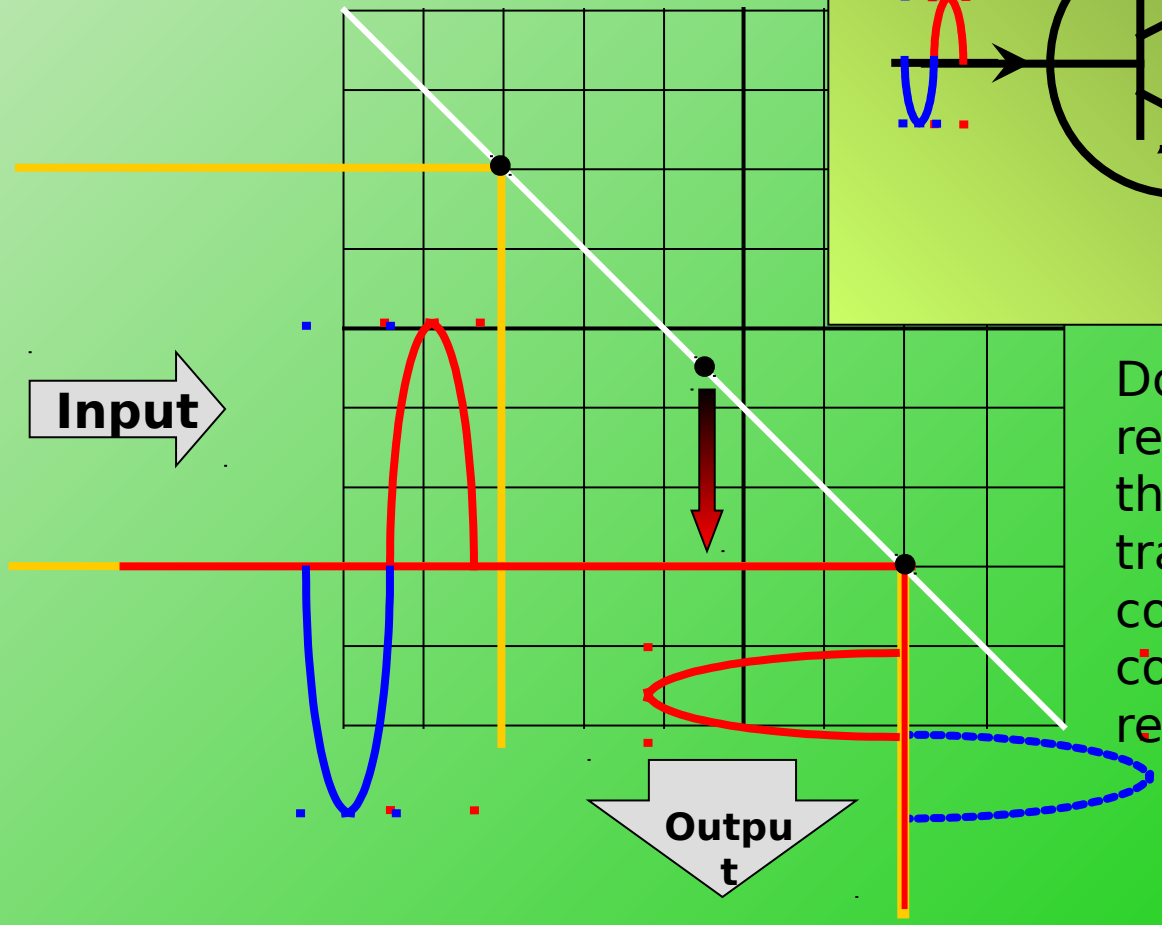
Class	Input	Output, % of I	Fidelity	Efficiency
A			****	*
AB		100%	***	**
B		99 - 51% 	**	***
C		**50%** 	*	****
		< 50%		

Class B Detail

TI: Transistor Configurations Part I

CLASS B AMPLIFIER





Dc Bias has been reduced where 50% of the time 180°, the transistor is conducting, and not conducting for the remaining 50% -180°.

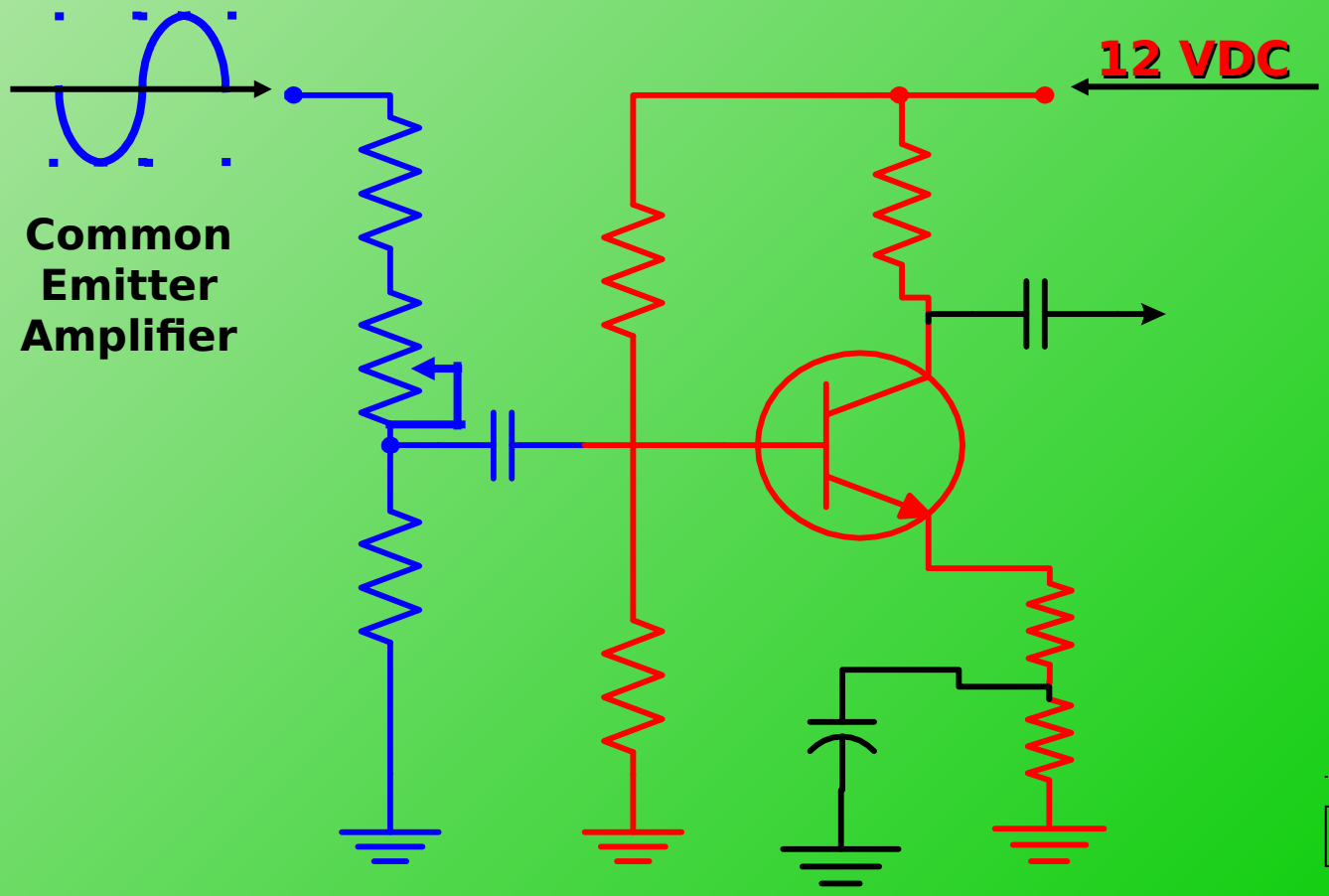
30A, Static / Dynamic

TI: Transistor Configurations Part I

2 MODES OF OPERATION:

Static, DC is Applied.

Dynamic, AC is Applied.

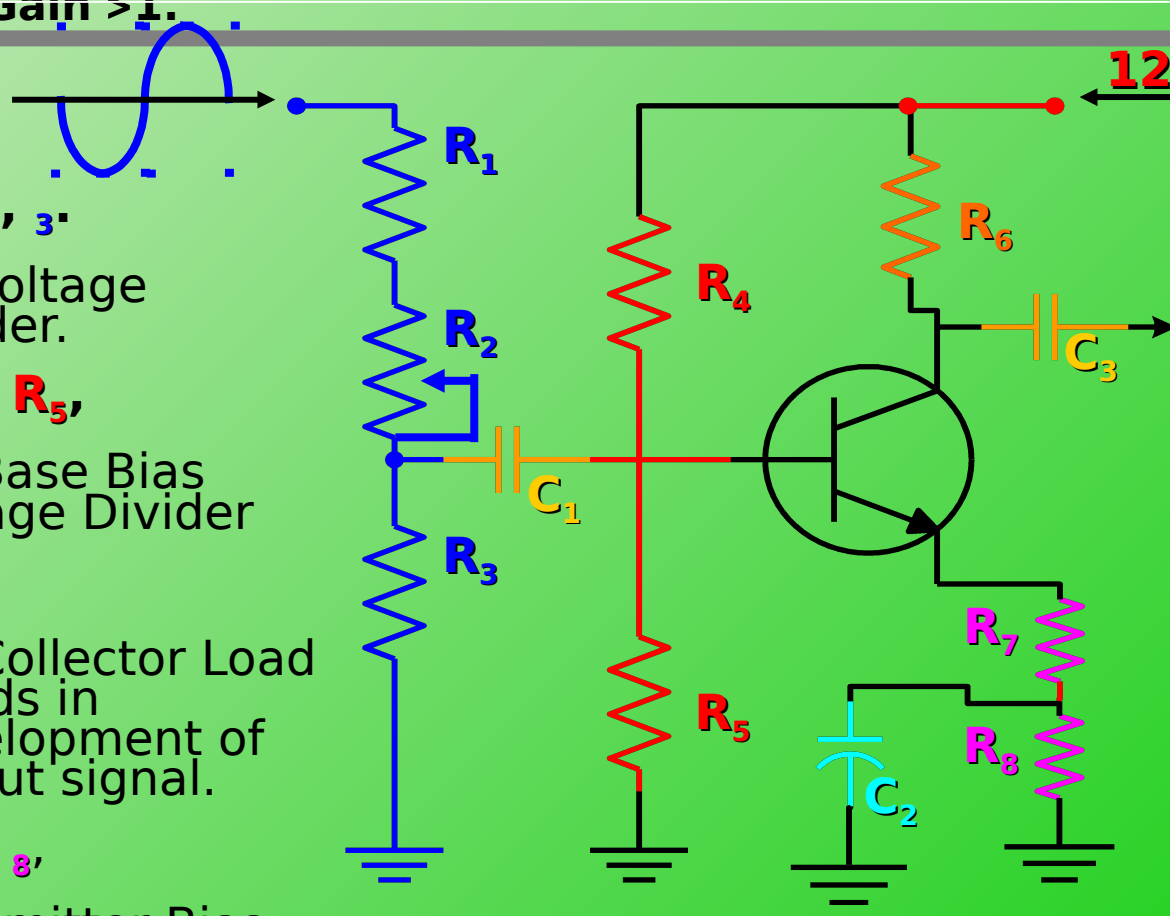


30A, CKT ID

TI: Transistor Configurations Part I

COMMON EMITTER AMP:

Power Amplifier, Output 180° out of phase w/ input. Power Gain >1.



R_1, $_2$, $_3$.

AC Voltage Divider.

R_4 & R_5,

DC Base Bias Voltage Divider

R_6,

DC Collector Load & Aids in development of output signal.

R_7 & $_8$,

DC Emitter Bias, prevents thermal runaway.

C_1,

Input Coupling Cap.

C_3,

Output Coupling Cap.

C_2,

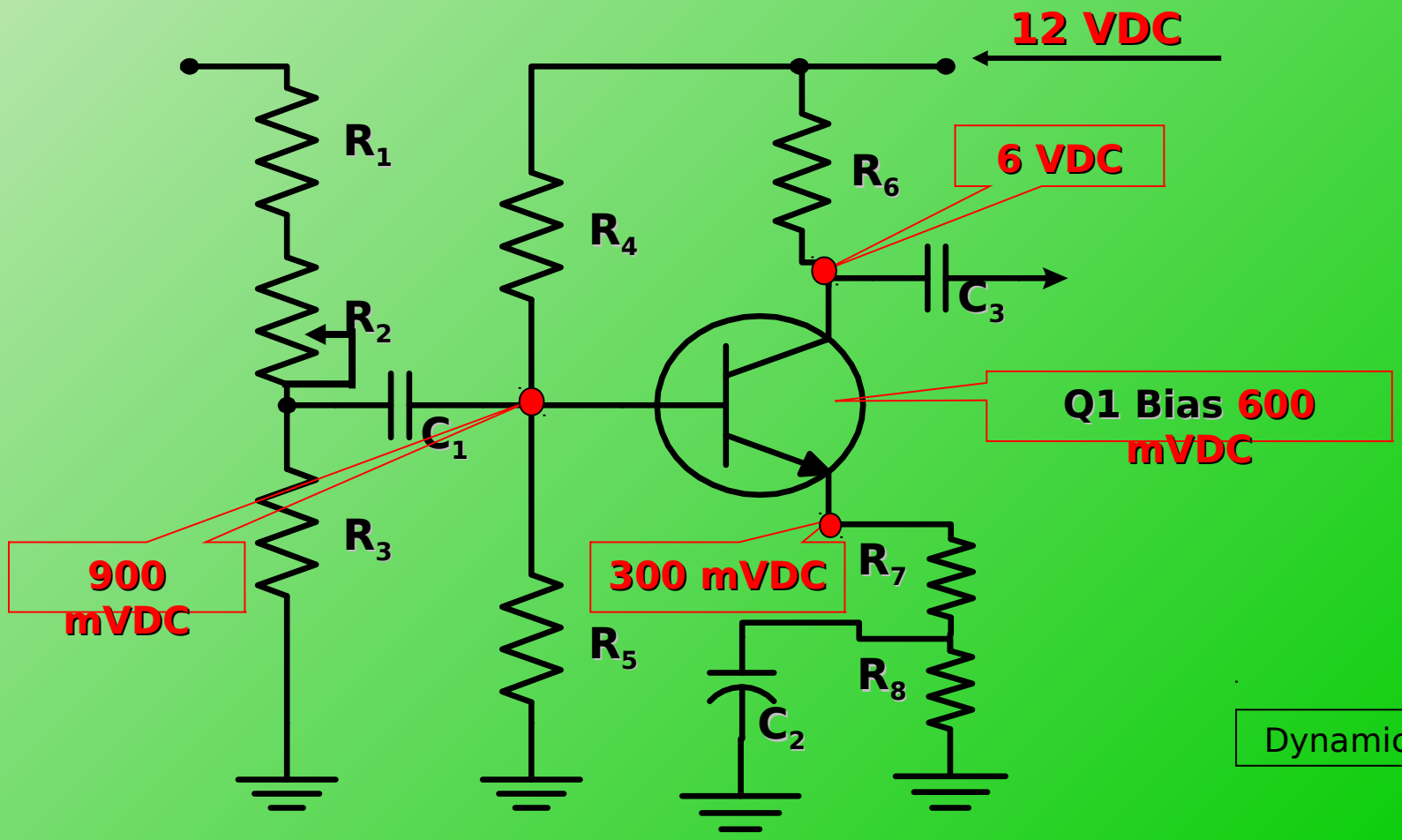
Bypass Cap, keeps signal from developing. Prevents degeneration.

Static / Dynamic Bias

TI: Transistor Configurations Part I

STATIC BIAS:

W/ 12 VDC applied the Collector, Base & Emitter Bias is set up. Q1 Bias is the difference of the Base & Emitter Voltages. B Base - E Emitter = Q1 Bias

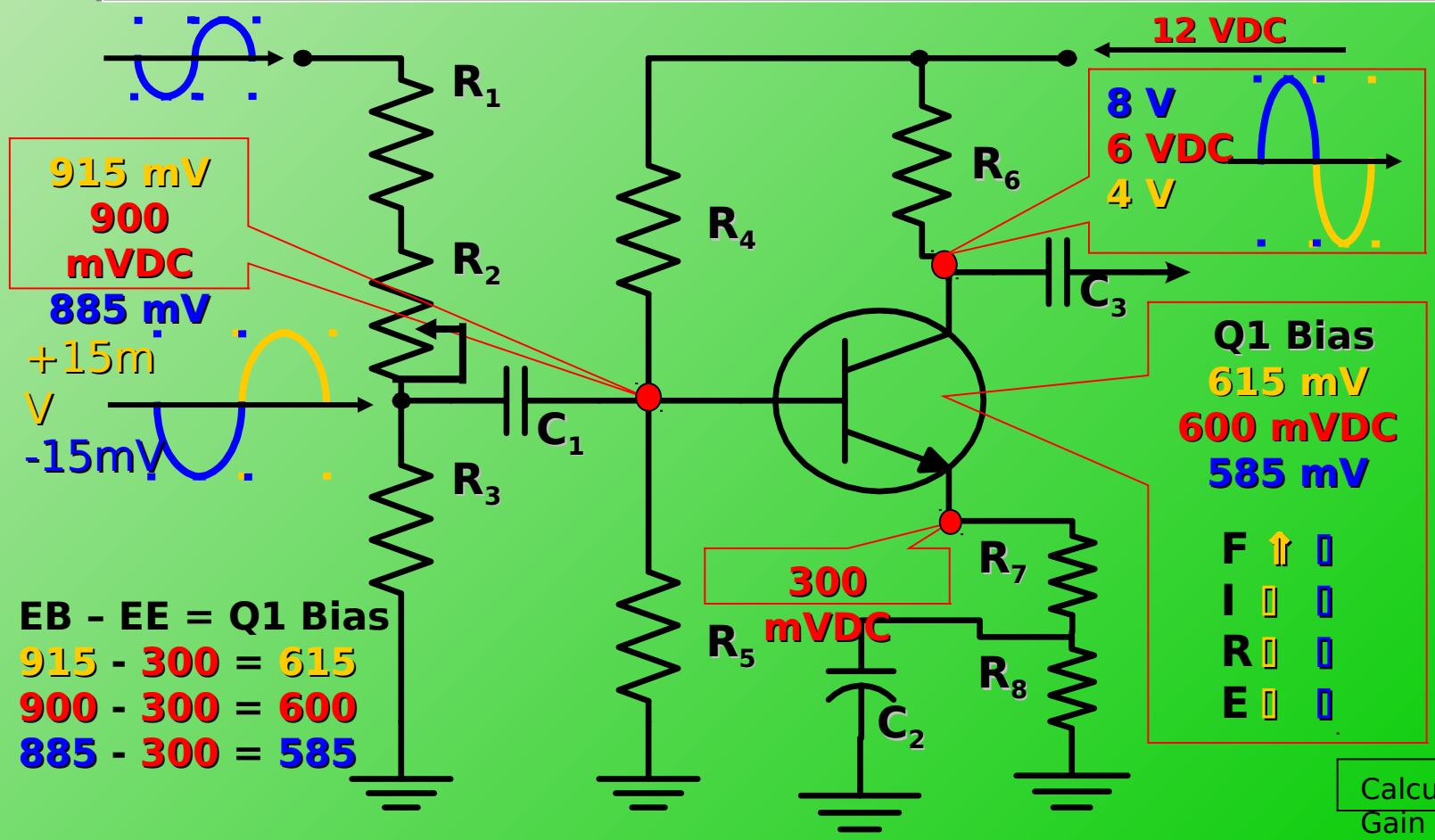


Dynamic Bias

TI: Transistor Configurations Part I

DYNAMIC BIAS:

W/ 30 mV pp applied, the Base Bias changes. Q1 Bias is changed, resulting in a change on the collector Voltage. B Base – E Emitter = Q1 Bias

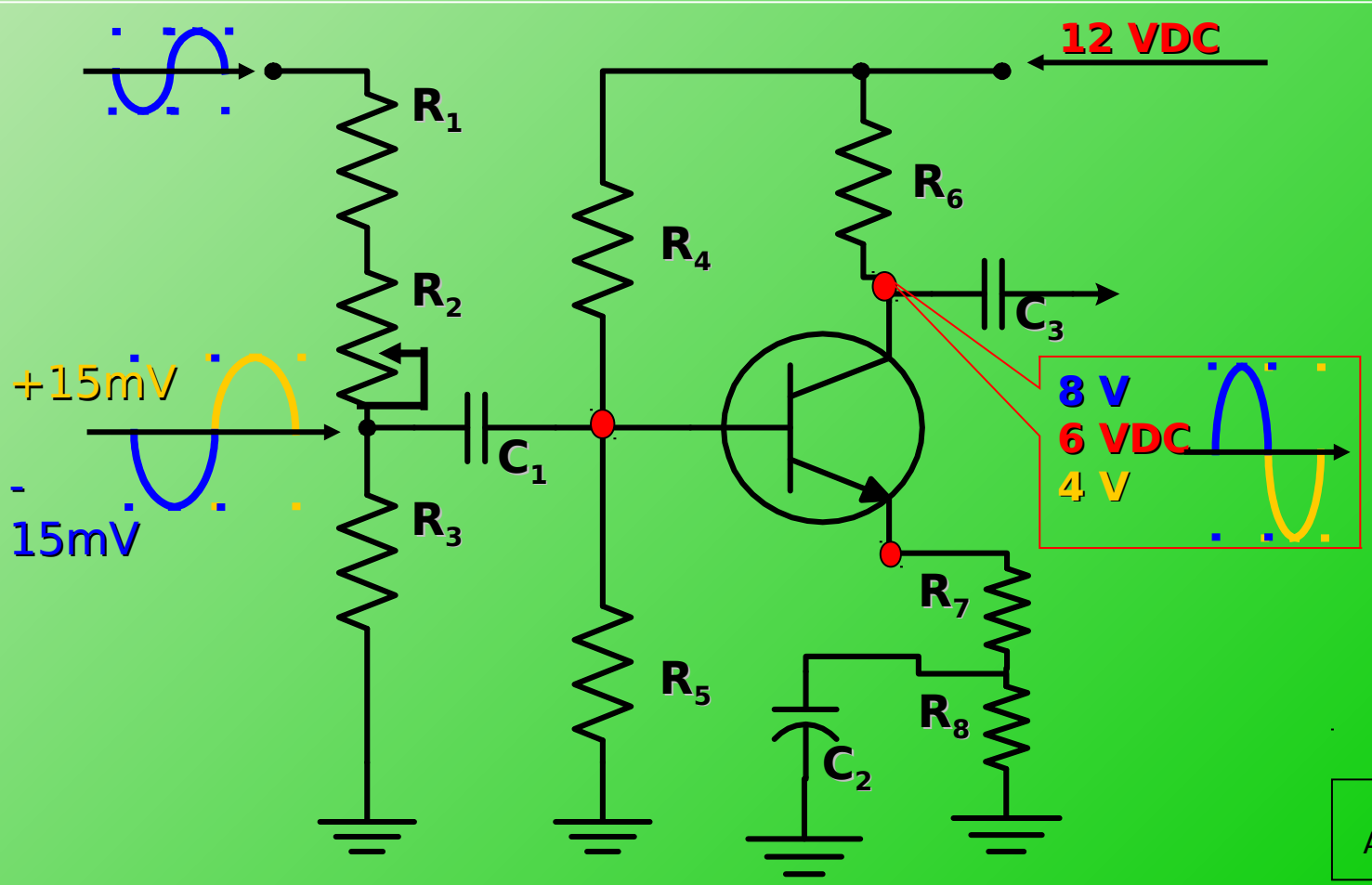


Calculate Gain

TI: Transistor Configurations Part I

Calculate Gain:

Based on the information given.

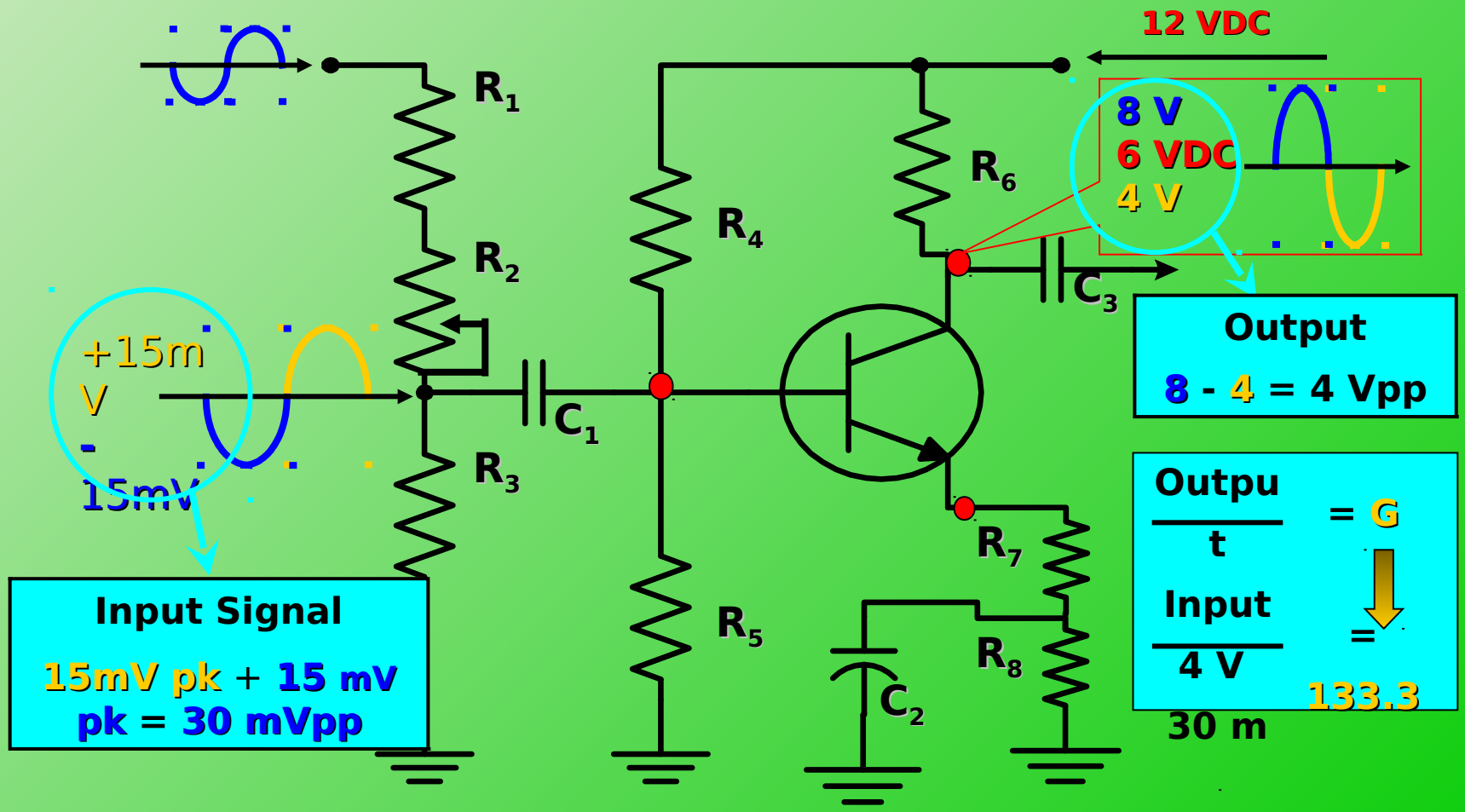


Gain Answer

TI: Transistor Configurations Part I

Calculated Gain:

Based on the information given.

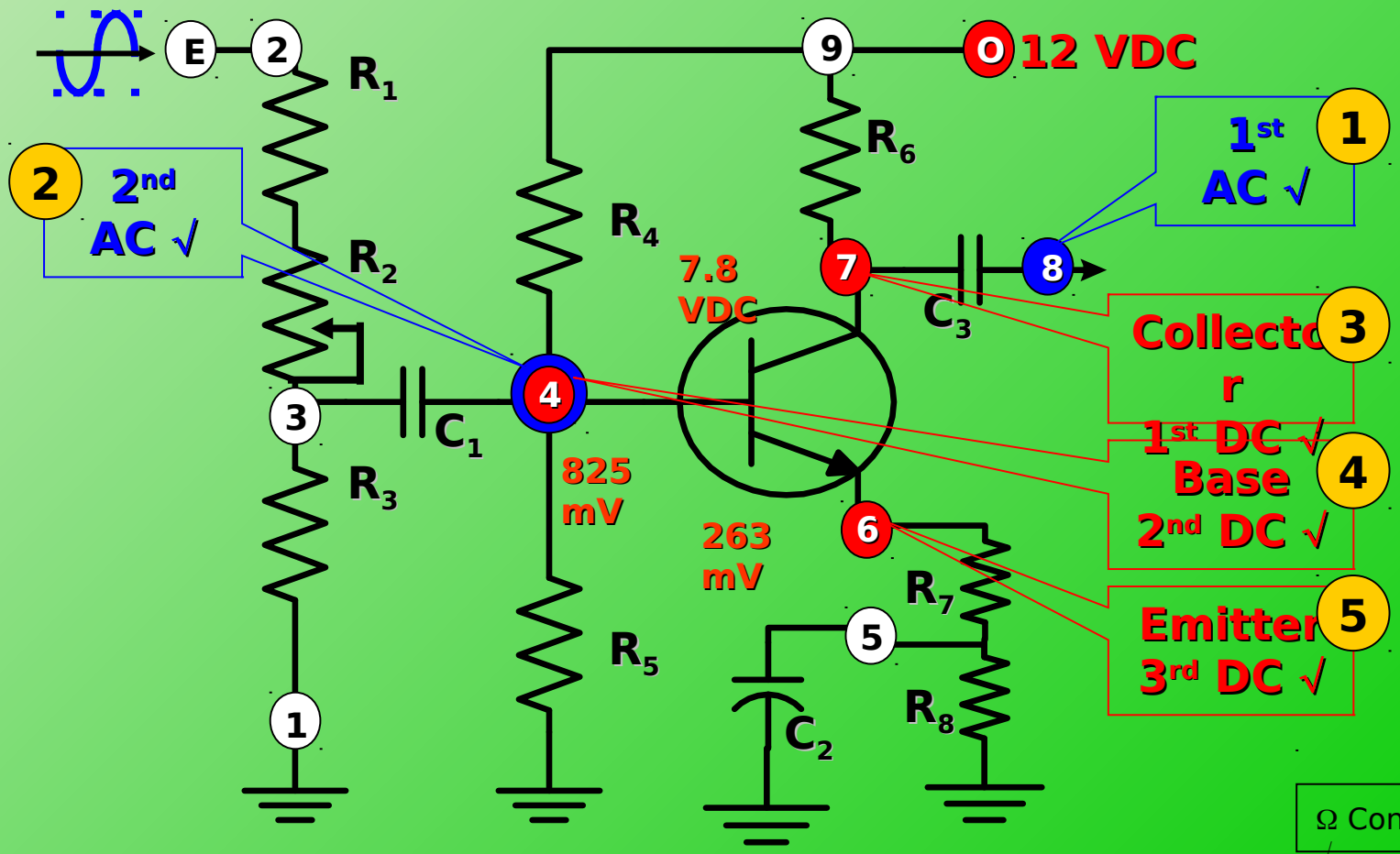


Troubleshoot Procedure

TI: Transistor Configurations Part I

Troubleshooting:

TP Check Procedure, <u>Must be</u> preformed & recorded in order. 2 AC √ , 3 DC √ .



Ω Confirmation √

TI: Transistor Configurations Part I

OHM OUT THE TRANSISTOR:

Final Check will always be the Ohm's confirmation Check. Ohming out a Resistor is accomplished as it has always been. The Transistor will require 2 √ between 2 elements.

Normal;

Q1, C to B = Hi / Lo

Q1, B to E = Hi / Lo

Q1, E to C = Hi / Hi

Open;

Q1, C to B = Hi / Hi

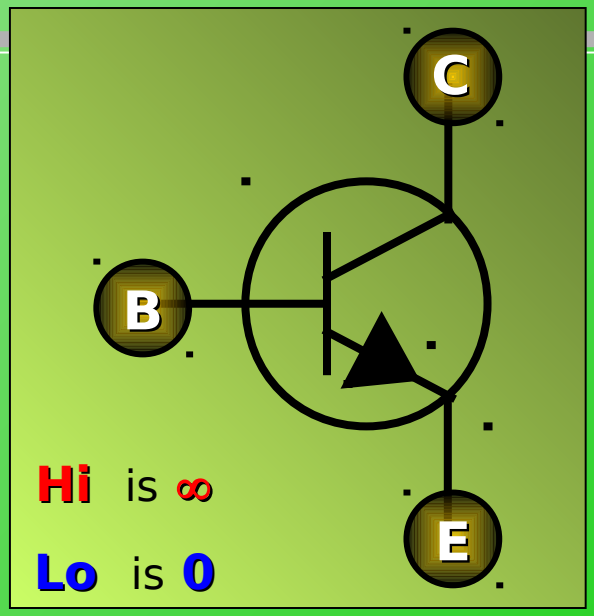
Q1, B to E = Hi / Hi

Short;

Q1, C to B = Lo / Lo

Q1, B to E = Lo / Lo

Q1, E to C = Lo / Lo



Hi = OL or >.67

Lo = Beep or <.66

Reference;
Condenser
Back page

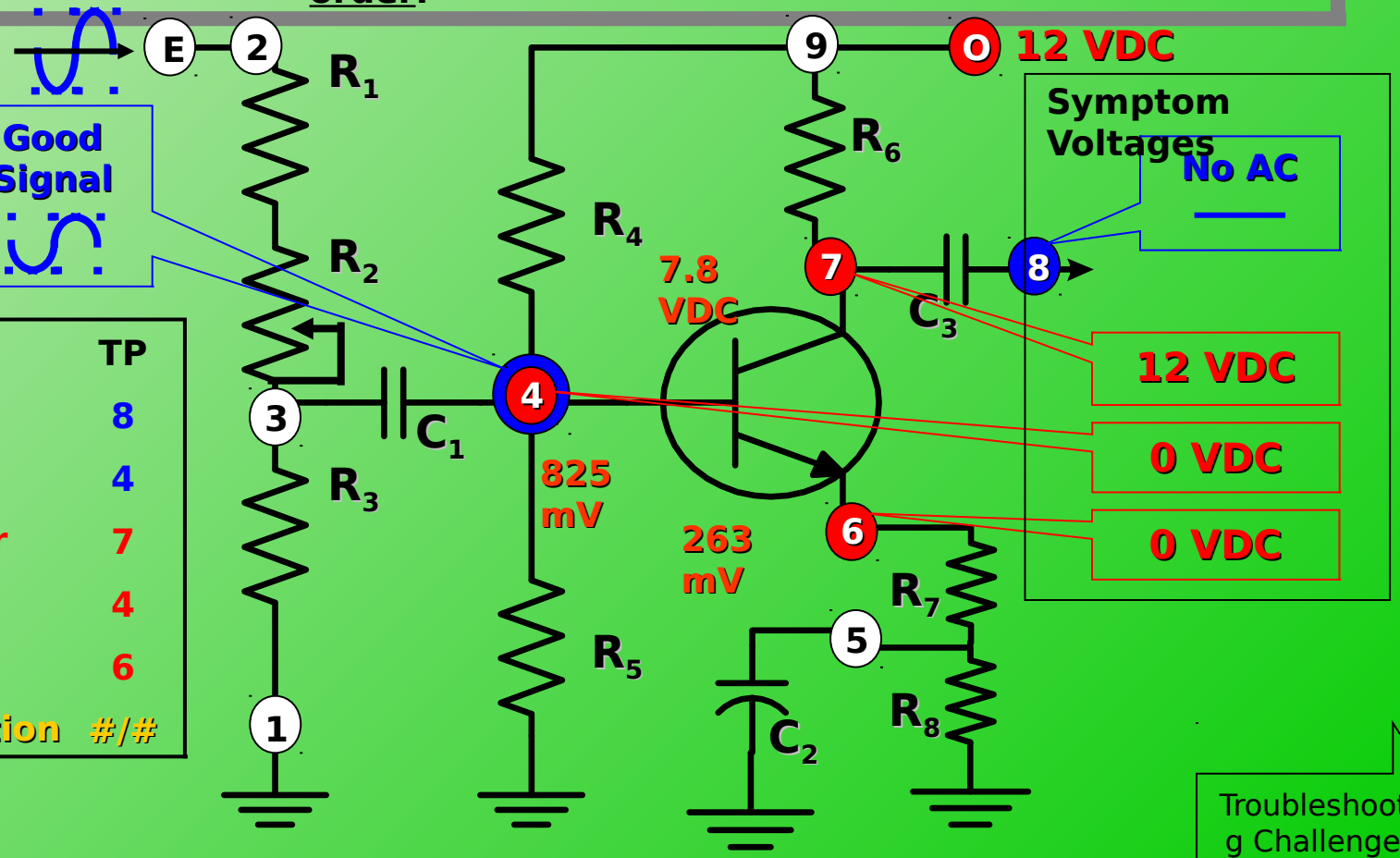
Set The DMM to Diode Check

Troubleshooting Challenge 1

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

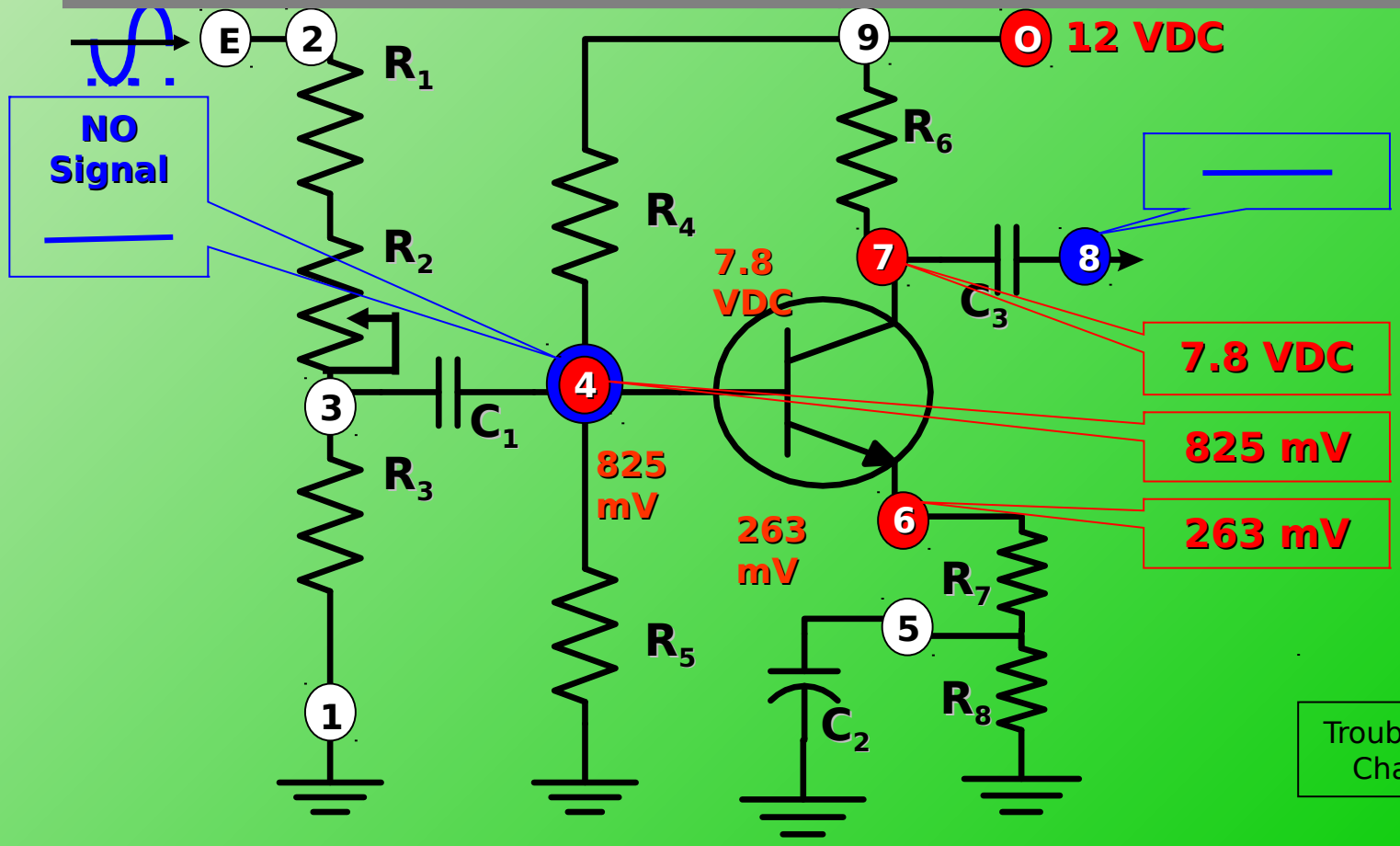


Troubleshooting Challenge 2

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

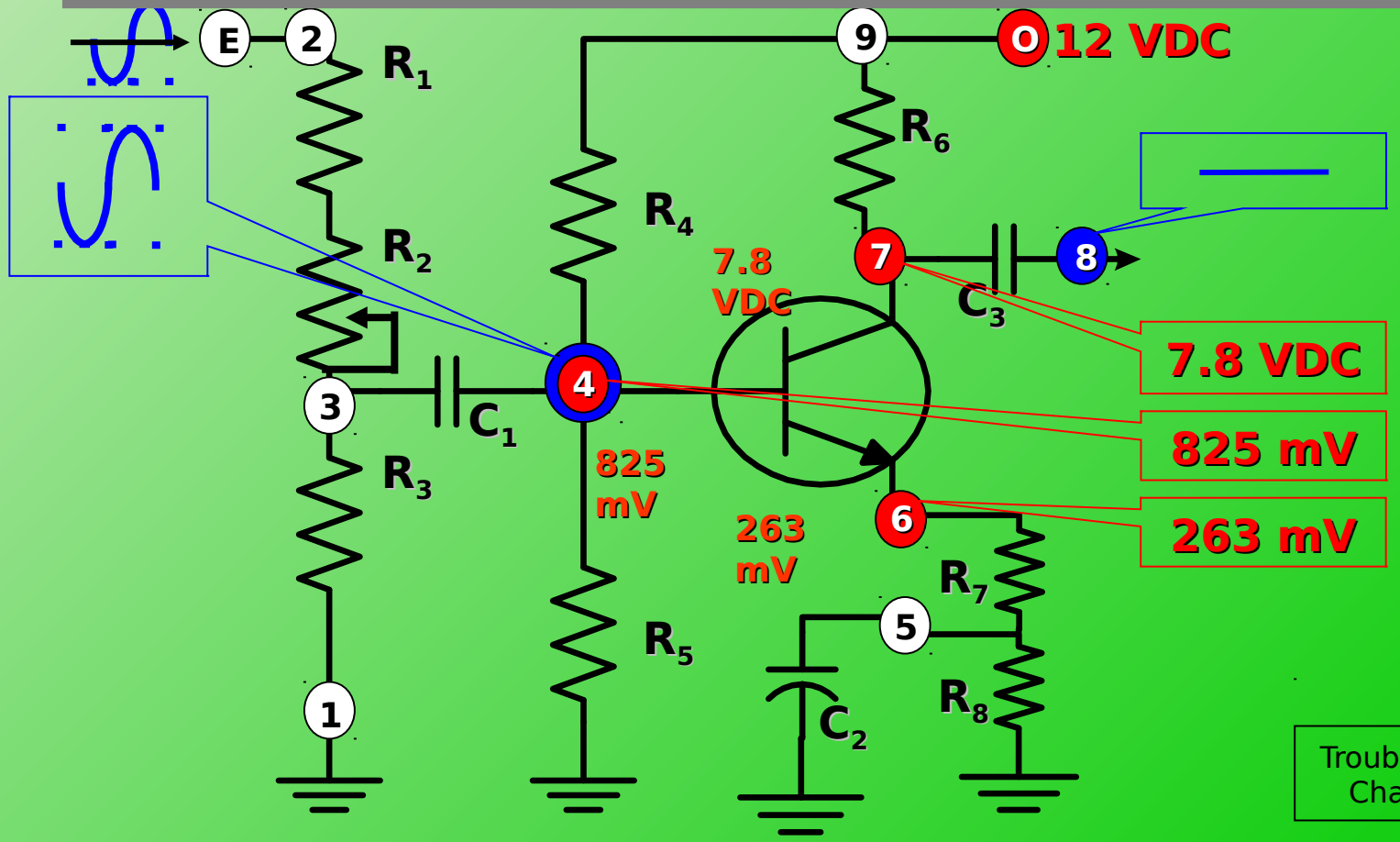


Troubleshooting Challenge 3

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

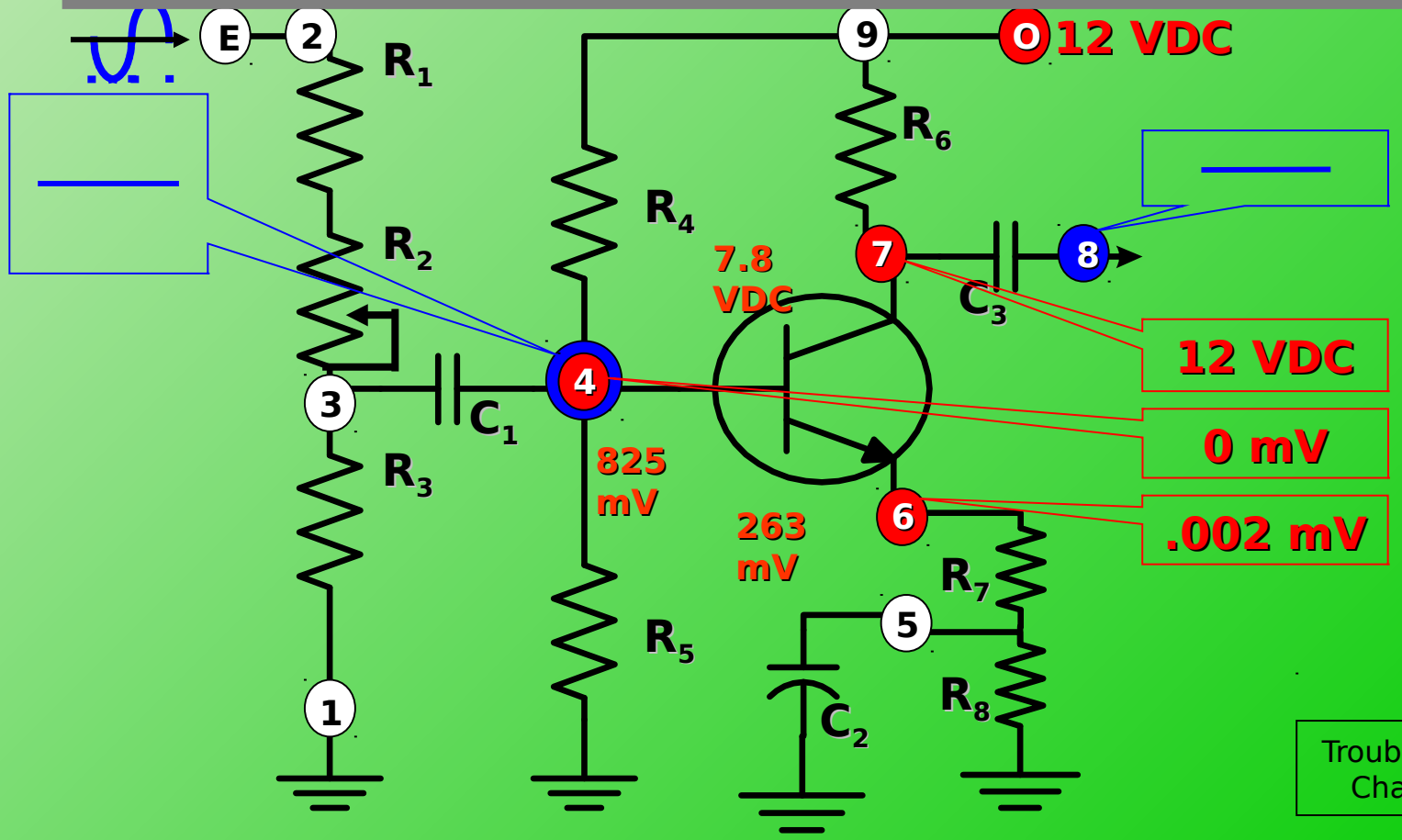


Troubleshooting Challenge 4

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

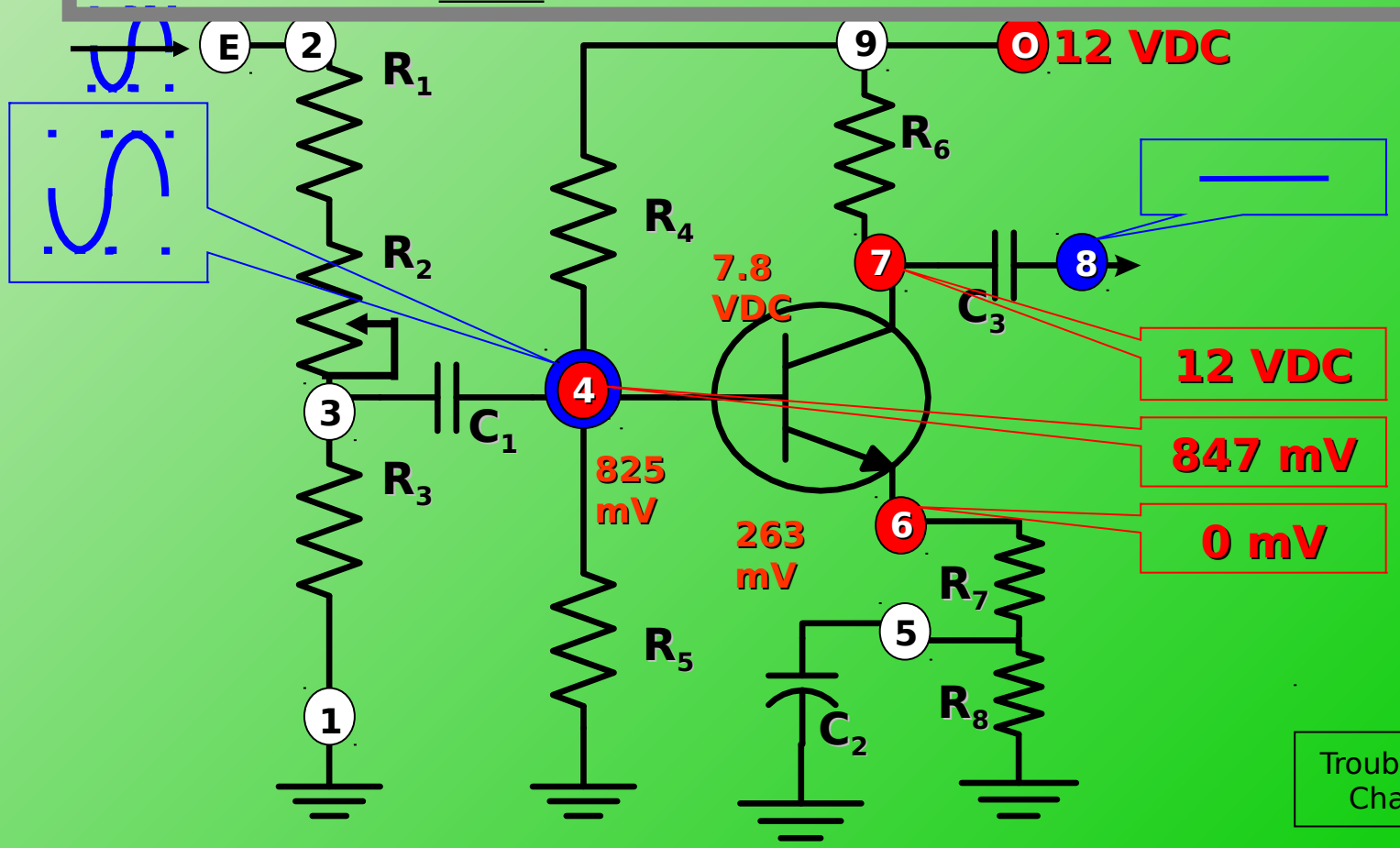


Troubleshooting Challenge 5

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

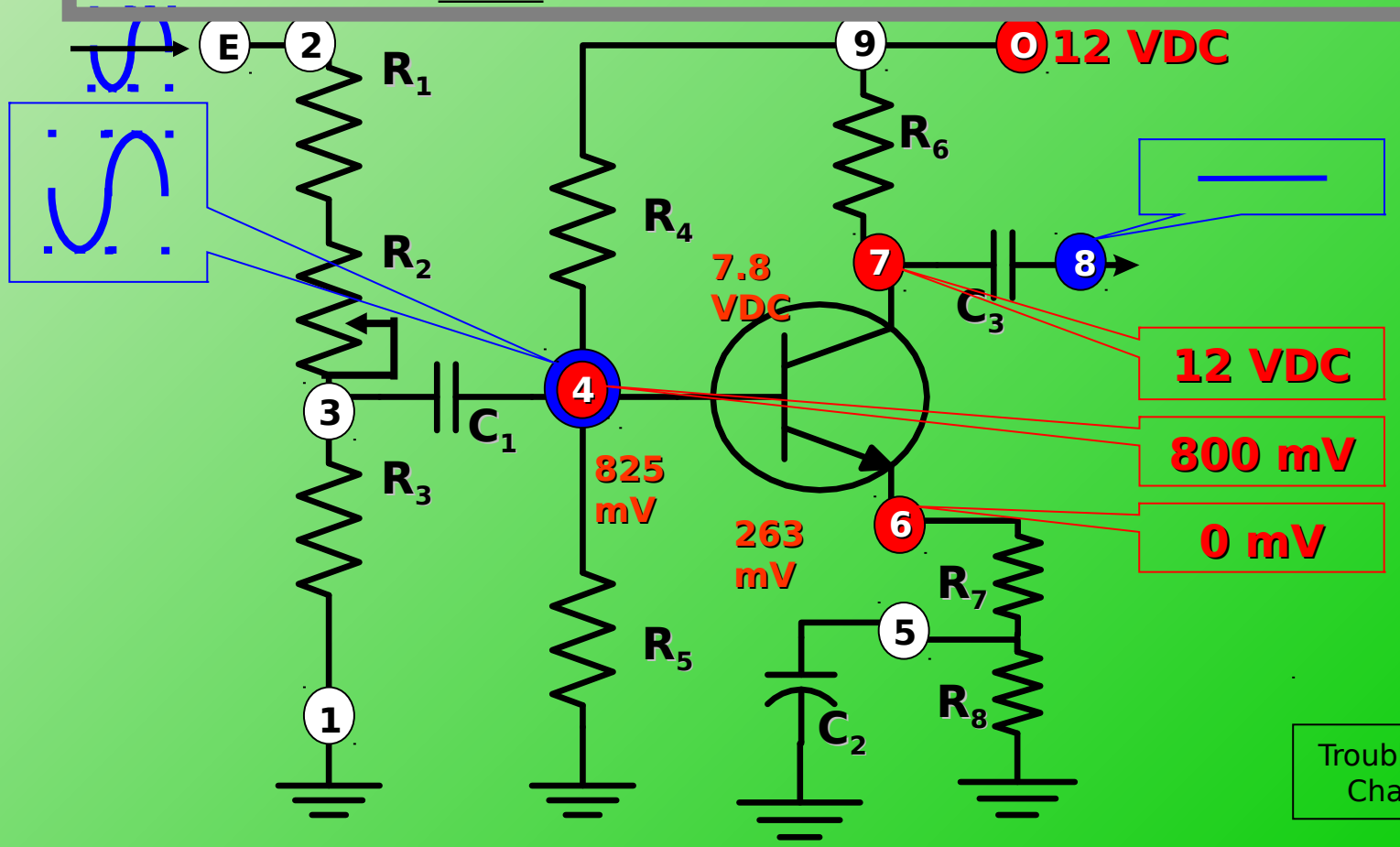


Troubleshooting Challenge 6

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

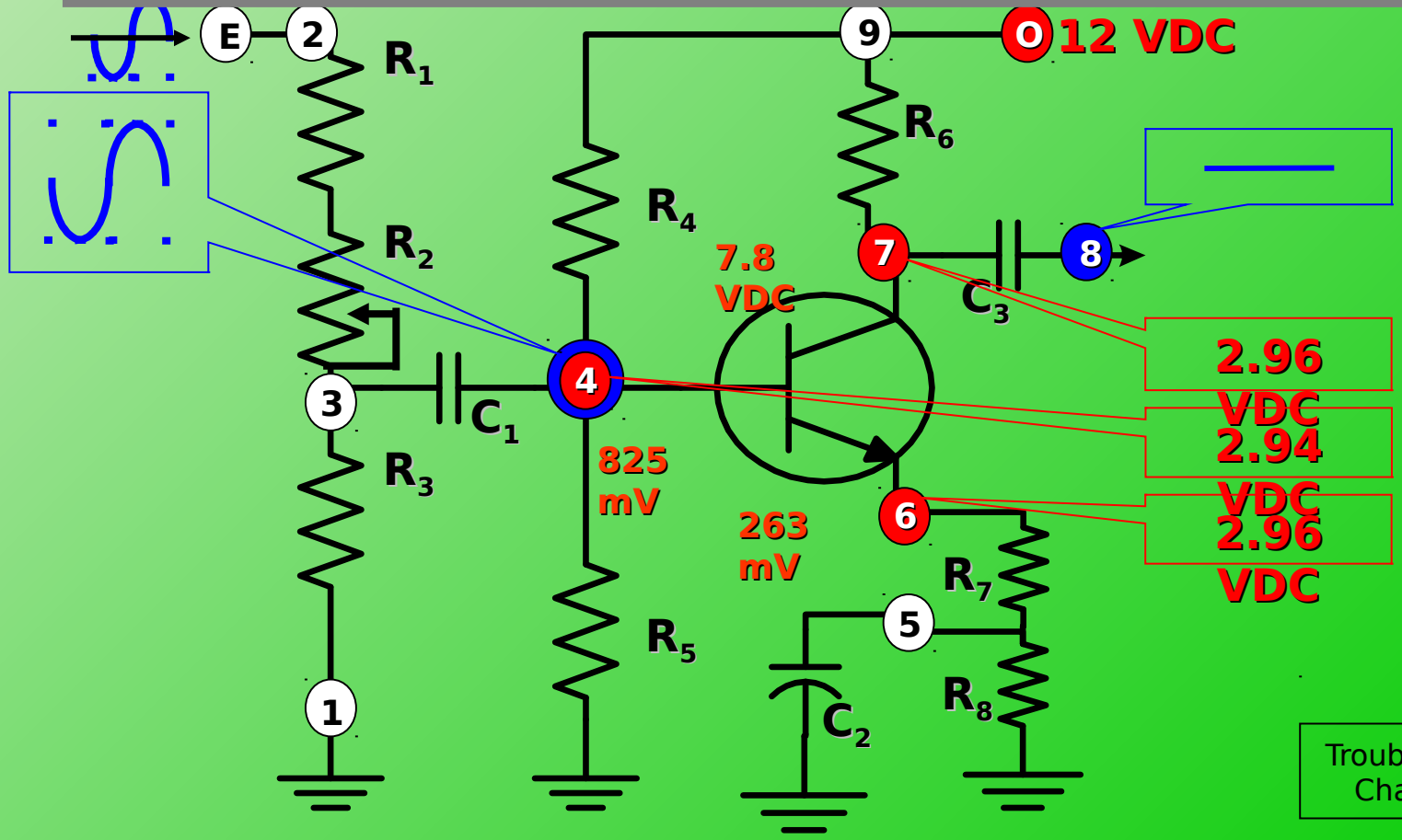


Troubleshooting Challenge 7

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

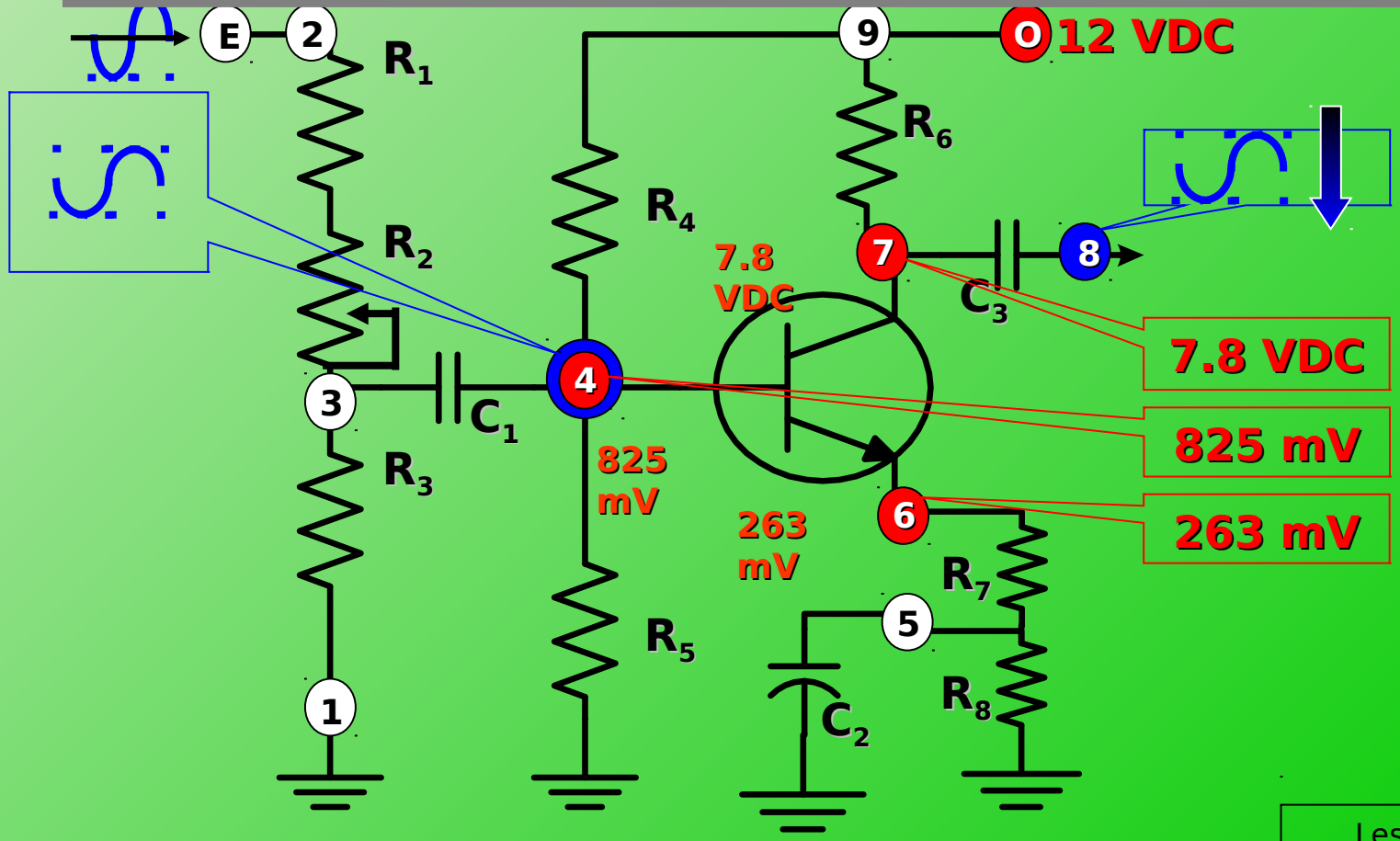


Troubleshooting Challenge 8

TI: Transistor Configurations Part I

TROUBLESHOOTING:

Based on the symptoms given, determine the malfunctioning component. Perform Checks in order.

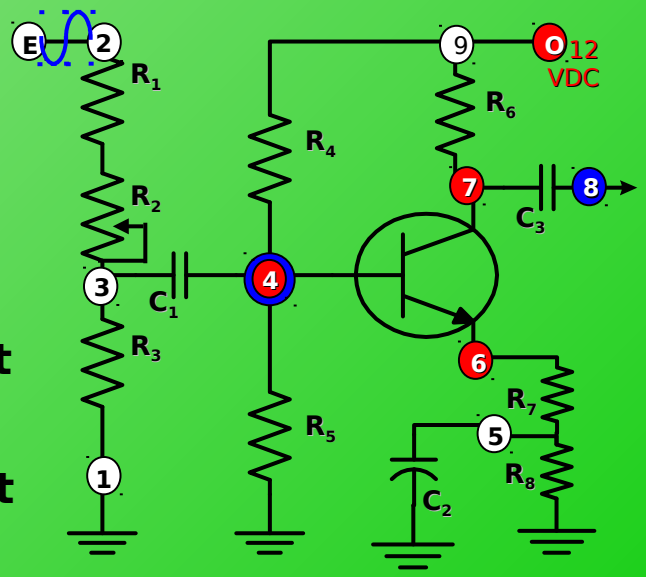


Lessons in Review

TI: Transistor Configurations Part I

REVIEW QUESTIONS: Reference, PC 30A Schematic for all ?

1. **What are the 2 operating modes of a transistor Ckt? _____ and _____**
2. **What is the purpose of C2, Emitter Bypass Cap? _____**
3. **What is the purpose of the Emitter Resistor in the CE Amp? _____**
4. **How can you determine if the Emitter Bypass Cap is Open? _____**
5. **Where is the first DC V measurement made in a Ckt? _____**
6. **What components would you suspect if there is no output signal, but the DC Voltages are normal? _____**
7. **Which resistor develops the output signal in the CE Amp? _____**
8. **Which Class of Amplifiers is the least efficient? _____**



Answers 1-8

TI: Transistor Configurations Part I

REVIEW QUESTIONS: Reference, PC 30A Schematic for all ?

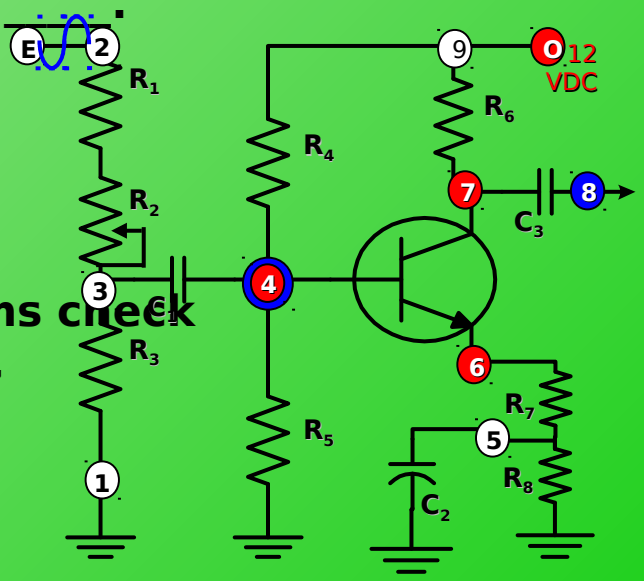
9. What are the 3 basic amplifier Configurations? ____, ____, ____.

10. What is the phase relationship between the input & output signal voltage in a CE Amp? ____ ___ __ _____.

11. How do you identify the common element of a transistor? _____

12. On PC Card 30A, the Collector reads applied voltage,the Base reads 0V and the Emitter reads 0V. An Ohms check between Tp4 & ground reads 7.5 KΩ, What is the Malfunction? ___ ____.

13. What is the purpose of R4 & R5 in PC-30A? ___ ____ ____ _____ _____



14. On PC-30A, the Collector measures 12V, Base measures 0V, Emitter measures 0V. Ohms check from Base Tp4, to Gnd reads 0 Ω. What is the Malfunction? ___ _____

Answers 9-14

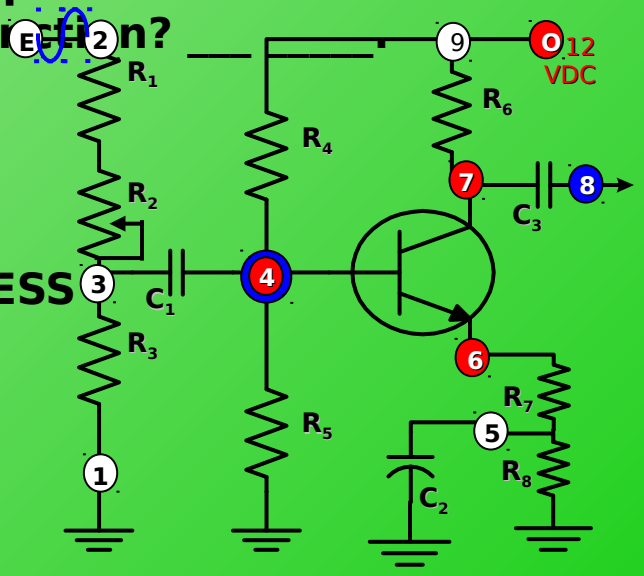
TI: Transistor Configurations Part I

REVIEW QUESTIONS: Reference, PC 30A Schematic for all ?

15. On PC-30A, the Collector measures 12V, Base measures 847mV, Emitter measures 0V. Ohms check from Tp6 to Tp4 reads infinite, Tp 4 to Tp7 reads infinite. What is the Malfunction? ____

16. Which class of amplifier operates for the entire input cycle? ____ .

17. Which of the following conditions will cause the transistor to conduct LESS [towards Cutoff] ?
    a. Decrease the resistance of R5
    b. Decrease the resistance of R4
    c. Open C1
    d. Increase the resistance of R5



18. When a positive alternation of the input signal is applied to Tp4, what happens to the voltage at Tp7 ? _____

Answers 15-18

TI: Transistor Configurations Part I

SUMMARY & REVIEW:

LESSON TEST:

Time; 20 Minutes.

Without Reference

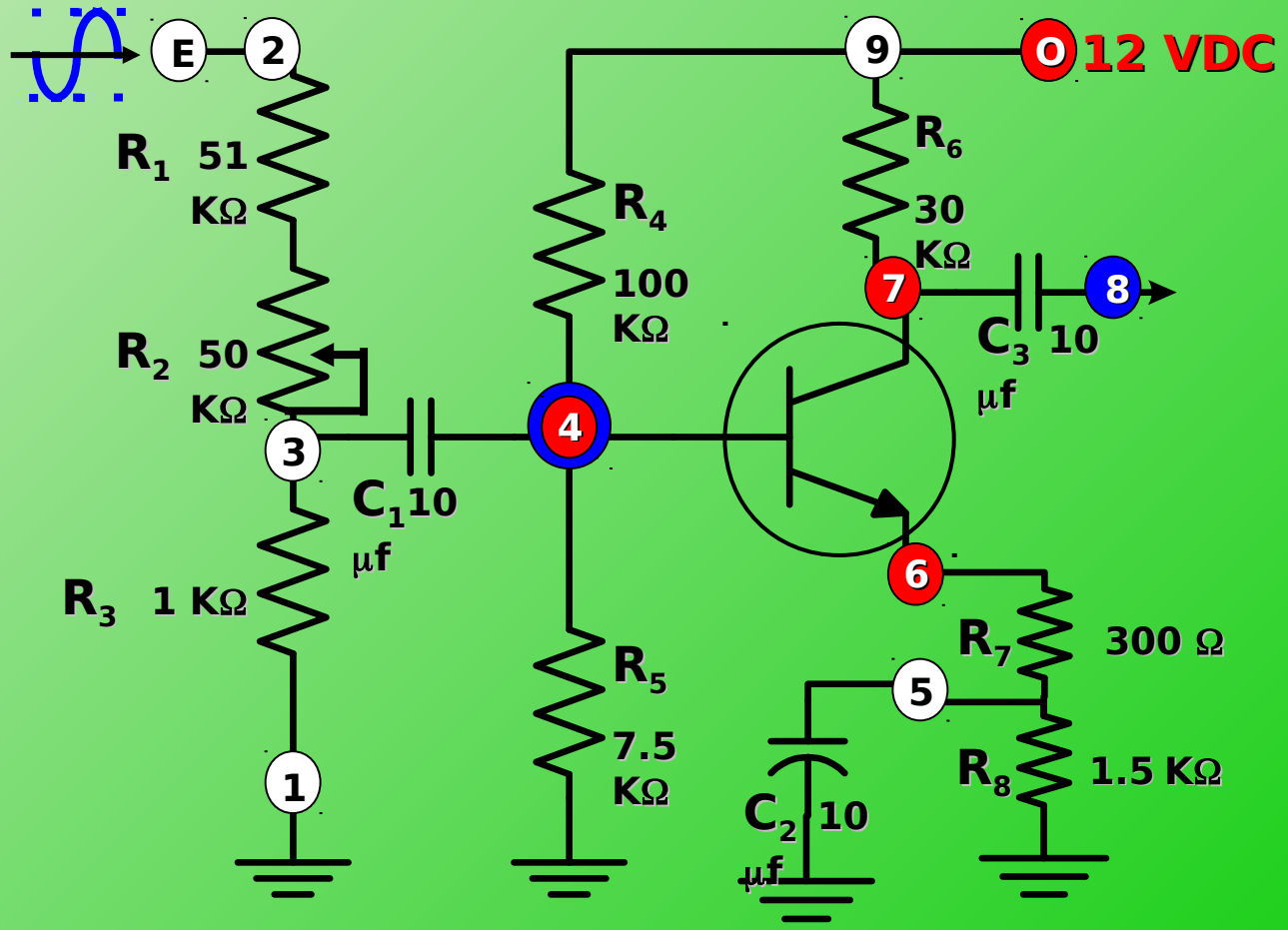
Standard;

Correctly answer 7 of 10 Questions.

30A schematic

TI: Transistor Configurations Part I

PC 30A CARD: COMMON EMITTER AMPLIFIER.



P/E Setup